Open Control Architecture (OCA)

Providing an open, scalable and transport-independent system control and monitoring standard to unify and manage professional AV network environments

Overview Whitepaper
Prepared by The OCA Alliance

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Introduction

Designing, deploying and managing professional media networks, such as for concert venues, touring shows, broadcast intercom, etc., can be particularly challenging because of the need to bring together a variety of AV equipment into a unified whole. While much progress has been made over recent years on standardizing signal level communications, there is no industry-standard method for managing the interconnected equipment to efficiently produce the desired results.

These challenges are made even more difficult by the frequent requirements to quickly adapt network configurations for the ad hoc accommodation of other equipment, such as concert tours, guest artists, special events, etc. For AV network managers and users, the optimal configuration needed to achieve artistic and fidelity objectives can be a constantly moving and elusive goal.

Counter-balancing the need for defining a common network control architecture is the importance that this standardization effort not result in a bland line-up of "common" equipment.

AV system manufacturers and artists must retain their ability to constantly innovate and push the envelope with exceptional capabilities and performance, while also having a control standard that enables every system in the network to achieve to its maximum potential.

This paper provides an overview of the ongoing standards-setting process and current status for the Open Control Architecture (OCA), which has been in development for the past two years under the auspices of The OCA Alliance, founded by a core group of leading companies in the AV industry.

OCA is dedicated to the premise that having a common control architecture for networked pro audio systems is both desirable and feasible. As an industry-developed control architecture, driven by the needs of both equipment makers and pro users, OCA is designed to work with all sizes of media networks and all kinds of audio transport schemes.

OCA is on track to become an open (i.e. license-free) public standard for media network control.

The OCA specification and technical documentation are freely available for download and OCA is gaining momentum through adoption by a widening range of pro AV equipment manufacturers.

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Professional AV System Requirements

Systems designed for professional AV applications must simultaneously deliver standout individual performance and be able to harmonize within complex networked environments. Depending on the specifics of the venue and the artistic requirements, every setup can present a unique set of challenges.

As professional level AV media networking becomes more widespread, system control will play a key enabling role for addressing the challenges presented by a variety of different situations.

The following sections provide a brief overview of four typical networking scenarios.

Large Installation Venues

These venues generally consist of permanent system installations that must be designed to provide an adaptable AV backbone for interfacing with a variety of internal and external systems. Examples of these venues include stadiums, multipurpose arenas, large auditoriums, etc. These installations have the following characteristics:

- Multiple program sources, control stations, loudspeaker clusters, and external interfaces.
- Interfaces to paging, signage, security, emergency, show video, security, and other systems.
- Interfaces to external systems - broadcast, internet, user devices (tablet, smartphone).
- Evacuation standards compliance may be required.
- Security may be required.
- Network infrastructures are typically administered by central IT.
- Large to very large network diameters.

Concert Tours

Concert tours increasingly present a mix of networking challenges in which the touring artists' systems need to be seamlessly integrated within each venue's in-house environment. The evolving set of requirements include:

- Multiple ad-hoc connections, varying from place to place, ideally using network audio
  For example: The prime contractor provides main loudspeakers and the subcontractors provide delay systems, fills, woofers, etc.
    - Connected to resident venue system for area fill.
    - Connected to show video systems, radio, TV, internet broadcast systems, recording systems, and press feeds
- System configured modularly, with multiple mix and loudspeaker/ amplifier subsystems, variously deployed from rental house(s) for different tours.
- Media transport may be a mix of Ethernet, AES3, MADI, AVB, Dante, etc.

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Intimate “Bar Band” and Nightclub Venues

These situations typically utilize small overall installations and entail a lot of diversity, however there is a trend toward more media networking. Future AV networks in nightclub venues will ideally provide a single media network connecting everything with the adaptability for integrating each act’s equipment. Issues that will need to be addressed include the following:

- Multiple house speakers, stage monitors, mixers, mics, ancillary gear
- In-ear monitoring system optional
- Powered loudspeakers, network-connected
- One main house mixer, tablet-based (no big mixing desk)
- Onstage monitor mixers for each musician - small tablets on mic stands
- Wired microphones connect through stage box on network
- Wireless microphones connect through receiver(s) on network
- In-ear monitors connect through transmitter(s) on network
- Wireless access to main house mix is an option
- Optional external interfaces, both analog and digital, to house systems
- Optional multitrack digital recorder on network
- Optional webcasting interface on network and on internet

Broadcast Intercom Networks

Broadcast intercom networks involve mission-critical applications and large complex media networking challenges; all with millions of dollars typically at stake. Key characteristics include the following:

- Thousands of intercom stations, with multiple control points
- Transcontinental networks using private leased data lines.
- Interfaces to broadcast mixing equipment.

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- VoIP interfaces
- Portable and fixed-location stations.
- Many subnets, multiple sites, multiple work environments within buildings, multiple remote locations.
- Network infrastructures may be administered by production intercom departments or by central IT.
- Frequent reconfiguration.

The Need for Control

In all of the above scenarios, there is a need for unifying the system control functions in a consistent manner that can seamlessly coexist with signal transport functions, both residing on top of the transport layer. It has become relatively easy to move signals from point A to B via standard transport protocols but, without also having a standardized control structure in place, these raw signals are not of much use.

Professional media networking requires both signal transport and system control.

As described in the following sections, the Open Control Architecture provides this system control functionality, while assuring compatibility with existing and future transport protocols and optimizing flexibility for unique feature differentiation between systems.

OCA Technical Overview

As a system control and monitoring architecture, OCA does not provide signal transport, but is designed to cooperate with current and future signal transport standards, such as the audio/video bridging (AVB) protocol suite now under development within the Institute of Electrical and Electronics Engineers (IEEE), and the IP-based media transport protocols defined by the Internet Engineering Task Force (IETF).

OCA's intended application is for professional media networks. In the broad scope, "Media network" means a network that interconnects audio and/or video devices for the purposes of program transport and system control. The current focus of OCA is on audio systems. However, the orderly expansion of OCA to cover control of video devices will be a straightforward matter.

Object-oriented, Tiered Architecture

OCA consists of three key parts:

- An Architectural Framework, which defines the set of structures and mechanisms upon which the rest of OCA reside.
- A Class Structure, which is the object-oriented, expandable, evolvable hierarchical structure, that defines OCA's repertoire of control functions.
- A suite of Protocol Definitions, which describe each implementation of OCA for each particular network type. Current focus is on the OCP.1 Protocol Definition, which describes the implementation of OCA for standard TCP/IP networks. Future protocol definitions will be created for USB and other interconnection methods.

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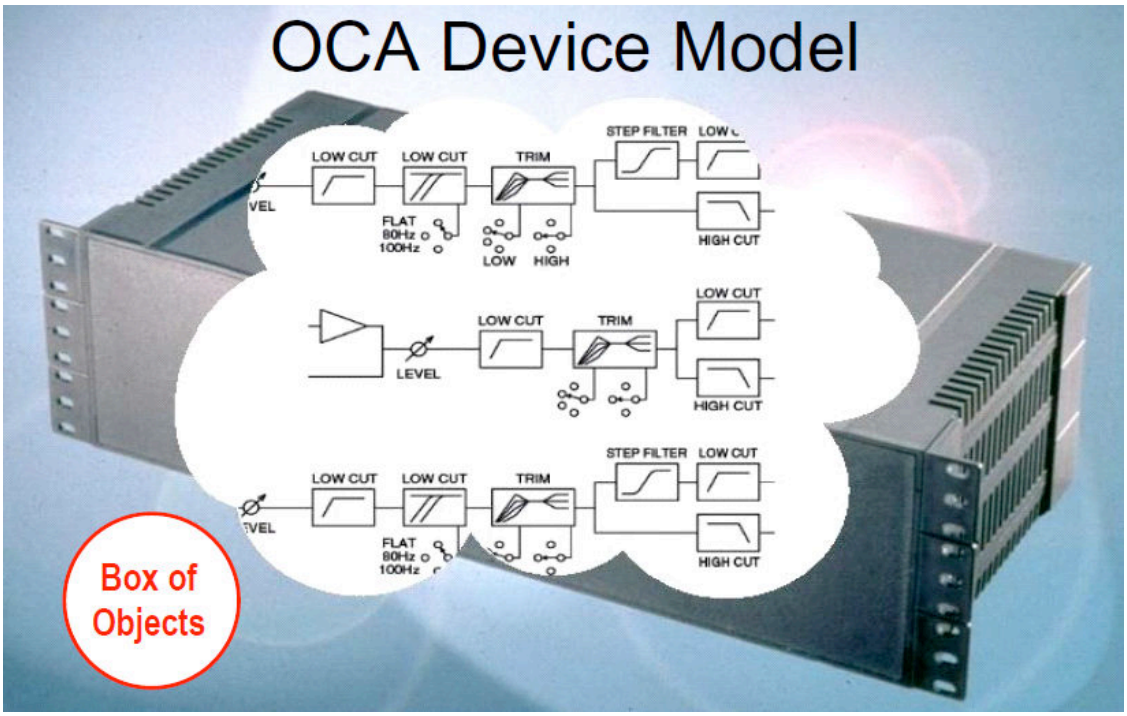
Current Repertoire of OCA Control Functions

The object-based class structure used in the OCA architecture enables a high level of adaptability to implement a wide range of control functions, along with the extensibility to incorporate new features and transport mechanisms in the future. In effect, OCA provides a “box of objects” for specific control functions that can be used to manage virtually any features for all systems within the media network.



The repertoire of control functions currently defined in OCA Version 1.1 includes:

• Gain Controls • Mutes • Switches (n-position) • Delays • Equalizers • Filters (IIR & FIR) • Limiters & Compressors • Expanders & Gates • Levelers • Matrices	• Signal generators • Arbitrary numeric parameters • Level sensors (meters) • Frequency sensors • Time interval sensors • Temperature sensors • Grouping (VCA groups) • Cross fading • Media connections & routing • Proprietary extensions

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The OCA Alliance

OCA is being developed and promoted by a trade association named **The OCA Alliance.** Originally established in June 2011 by nine leading companies in the pro audio sector, the Alliance is focused on developing and promoting industry-standard system control capabilities for professional media networks. The goal of the Alliance is to enable devices from multiple manufacturers to share a common management regime, thereby enabling both system designers and users the freedom to specify the components that they want, without compromising on either overall integration or usability.

OCA's Ancestry

The OCA standard has its roots in the AES-24 protocol, originally developed by the Audio Engineering Society for system control in the 1990s. Through the efforts of the Alliance member companies, the standard has been expanded and refined to provide adaptability across the full range of use cases, encompassing both large and small media networks, as well as future-proof extensibility for handling new features, transports and use cases.

Addressing Needs of Pro-Users and Equipment Providers

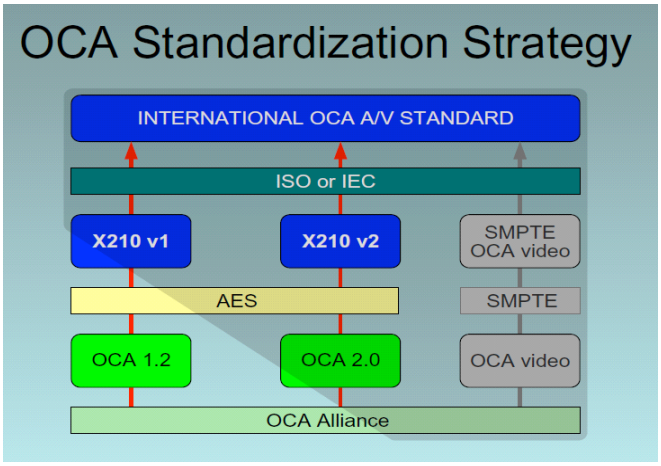
The Alliance is dedicated to the concept that establishing a common control standard does not in any way need to compromise the ability of equipment manufacturers to continue creating products with unique personalities and clear differentiating features. To the contrary, the member companies know that *enabling all systems in a media network to communicate more effectively actually makes it easier for users to choose the best solutions for every need, thereby making differentiation more important.*

OCA Standards Process

Since its inception, the Alliance has been on a fast-track to refine the OCA specification and prepare it for passing to a public standards organization.

Current Status

In late 2012, the Alliance and the Audio Engineering Society (AES) jointly announced an AES standards project to consider the OCA specification a public standard. The project, identified as AES-X210, will: "produce a public, open and royalty-free communications protocol for reliable and secure control and monitoring of interconnected audio devices in networks of 2 to 10,000 elements."



These efforts also laid the groundwork for potentially obtaining ISO and/or IEC recognition, which will help establish OCA as an internationally accepted standard for media network system control and monitoring.

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With the OCA standards process well under way, the adoption of OCA as an integral element within new equipment designs is becoming more widespread. OCA is designed for flexible integration with virtually any set of features and supports a high level of product differentiation. Manufacturers are now learning how to use it to extend product functionality and compatibility while maintaining product distinction.

Summary

In today's complex media networks, simply transporting signals between devices is not enough -- comprehensive system control capability is also required. OCA addresses this requirement by providing a common control architecture that works with any media transport protocol.

Pro audio networking users and applications span a wide range of requirements. In all scenarios, users would like the ability to select the best equipment for each application, with the reliance that all it will work together seamlessly. OCA, as it becomes more widely adopted, promises to provide this kind of compatibility for system control.

If you are interested in learning more about OCA, becoming a member of The OCA Alliance, and/or implementing OCA in equipment designs, please visit us on the web at www.oca-alliance.com .

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